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Anatomical Characteristic of the Pelvic and Thigh Region Muscles of Javan Pangolin, *Manis javanica*

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INTRODUCTION

Javan pangolin (*Manis javanica*) that commonly known as scaly anteater is a unique mammal since toothless and the body is covered with horny scales. The animal has unique defense mechanism such as enforcing scales or roll up the body when threatened, so the hard keratin scales will protect the body from predators [1]. Pangolin is solitary and nocturnal animal. They feed on ants and termites exclusively, represented their name [2]. They look for feed by digging a nest of ants or termites in the soil or climbing up a tree. All extinct activities are presumed requiring specific anatomical structure, including the pelvic and thigh region muscles. The study aims to examine the anatomy of the pelvic and thigh region muscles of Javan pangolin including its origin and insertion associated with the function of each muscle.

MATERIALS AND METHODS

The study were used two male specimens of Javan pangolin preserved in 10% formalin. The observation of structure, origin and insertion of each muscle was done, by dissecting the skin, and superficial and deep muscle layers. The muscle names were noted based on Nomina Anatomica Veterinaria 2012 [3].

RESULTS AND DISCUSSION

The muscles observed on the pelvic and thigh region were composed of cutaneous, psoas minor, iliopsoas, quadratus lumborum, tensor fasciae latae, gluteus superficialis, gluteus medius, piriformis, gluteus profundus, biceps femoris, abductor, semitendinosus, semimembranosus, quadriceps femoris, gemelli, obturatorius externus, obturatorius internus, sartorius cranialis, sartorius caudalis, gracilis, pectineus, adductor longus, adductor magnus dan adductor brevis. The interesting finding of the study were noted of thick and wide distribution of cutaneous, semitendinosus which have small muscles projected from one third of distal part, a relatively developed of psoas minor, three venter of adductor and presence of abductor muscles. These muscle structure might be closely related to the adaptation and behavior of this animal to roll up the body, erecting the scale, and digging burrows or nest of ants and termites.

The defense mechanism of Javan pangolin to roll up the body and erect the scale might be supported by thick and wide distribution of cutaneus muscle. The muscle covered lateral and dorsal part of body extend toward the pelvic and thigh region. Besides the semitendinosus have a small muscles projected from one third of distal part and inserted to the fascia (Fig 1). Those might be function as scale retractor to the origin position. While rolling up activities were also supported by developed of psoas minor and adductor muscles which has three venter longus, magnus and brevis. The vertebral construction with interlocking articulation which connecting accesory process and cranial articular process was strengthening the rolling position [4].

Javan pangolin is a good digger and climber. Pangolin digging the deep burrows and nest of ants and termites to look for feed. When digging burrows, pangolin used hind limb to remove the soil from the hole. This activities should be support by combination flexion and extension of hip and knee joint. The flexor and extensor muscles that contribute to the activities were tensor fasciae latae, quadriceps femoris, gluteus medius, gracillis, semimembranosus, sartorius cranialis and

sartorius caudalis (Fig 1 and 2). The activities was also supported by abductor muscle which origin from lateral part of the femoris and inserted into the distal part of tibia (Fig 2). The muscle was relatively thick and wide which presumed to strengthen abduction the hind limb when remove the soil from the hole. The muscle was not reported in other mammals yet so far.

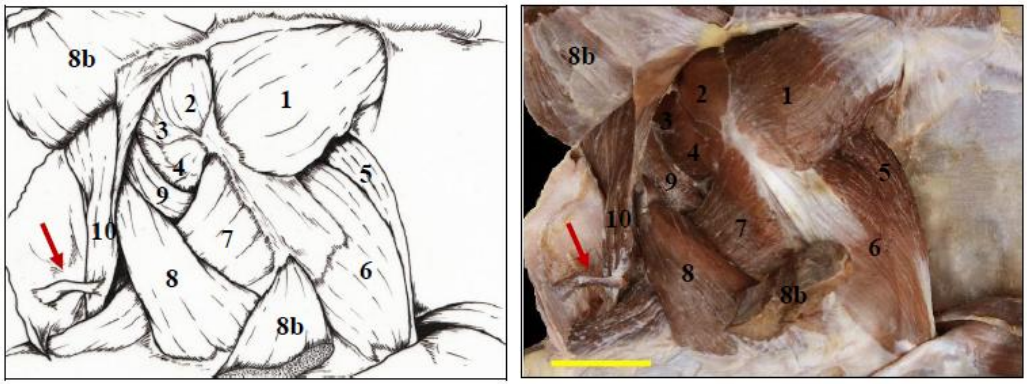

Figure 1 Lateral thigh muscle. 1. *m. gluteus medius,* 2. *m. gluteus superficialis,* 3. *m. piriformis*, 4. *m. quadratus femoris,* 5. *m. rectus femoris*, 6. *m. vastus lateralis,* 7. *m. abductor,* 8. *m. biceps femoris (a. caput ischii, b. caput sacrale),* 9. *m. adductor longus,* 10. *m. semitendinosus* with small muscle project from the distal (arrow). Bar : 3 cm.

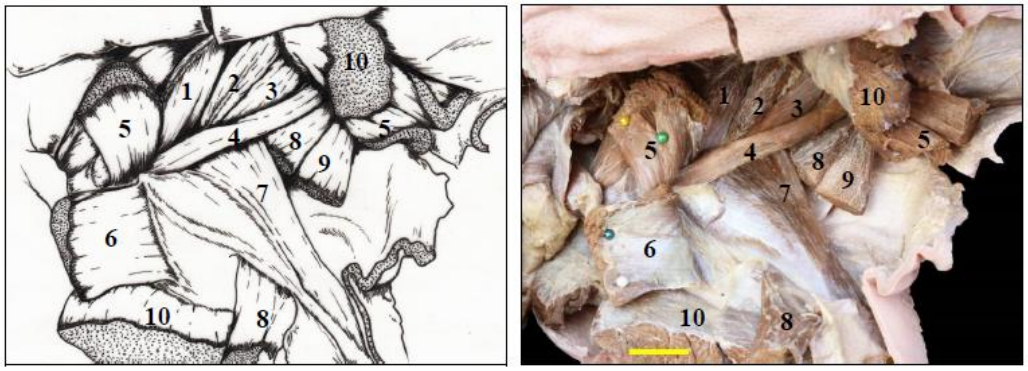

Figure 2 Profundal thigh muscles. 1. *m. sartorius caudalis,* 2. *m. pectineus*,3. *m.adductor brevis,*4. *m. adductor longus,* 5. *m. adductor magnus,* 6. *m. semimembranosus,* 7. *m. abductor,* 8. *m. semitendinosus,* 9. *m. biceps femoris caput ischii,* 10. *m. gracillis,* Bar : 3 cm

CONCLUSION

The structure of pelvic and thigh muscles of Javan pangolin were unique that peculiar to their behavior. The cutaneus was thick and wide, the psoas minor were relatively developed, the adductor have three venters and presence of abductor muscles which was not reported in other mammals yet so far. These muscle structure might be closely related to the adaptation and behavior of defense mechanism and digging activity.

ACKNOWLEDGEMENT

The structure of pelvic and thigh muscles of Javan pangolin were unique that peculiar to their behavior. The cutaneus was thick and wide, the psoas minor were relatively developed, the

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